Retraction

Retracted: Supply Chain Inventory Collaborative Management and Information Sharing Mechanism Based on Cloud Computing and 5G Internet of Things

Mathematical Problems in Engineering

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] F. Zhang and Z. Gong, "Supply Chain Inventory Collaborative Management and Information Sharing Mechanism Based on Cloud Computing and 5G Internet of Things," *Mathematical Problems in Engineering*, vol. 2021, Article ID 6670718, 12 pages, 2021.

Research Article

Supply Chain Inventory Collaborative Management and Information Sharing Mechanism Based on Cloud Computing and 5G Internet of Things

Fuan Zhang [1] and Zhenzhi Gong[2]

[1]*School of Information Engineering, Yangzhou University, Yangzhou 225009, China*
[2]*Industrial Economics Research Institute, Yangzhou University, Yangzhou 225009, China*

Correspondence should be addressed to Fuan Zhang; fazhang@yzu.edu.cn

With the development of economic globalization, the competition among enterprises is increasingly fierce. Therefore, companies need close information sharing to realize the integration of supply chain. This article aims to study the collaborative management and information sharing mechanism of supply chain inventory based on cloud computing and 5G Internet of Things. This article first introduces the theory and methods of collaborative supply chain management and the information exchange mechanism and then discusses the problem of information sharing in the supply chain, that is, the bullwhip phenomenon, and then from the demand forecast, supply chain structure, time lag, and shortage game, six aspects are analyzed. The cause of the bullwhip phenomenon is analyzed. Secondly, this article proposes a quantitative analysis of the bullwhip effect, establishes a mathematical model of the bullwhip effect in the supply chain, and uses quantitative analysis to analyze the value of information sharing in the supply chain. Finally, this article uses cloud computing technology to build a supply chain information collaboration system architecture and uses EPC Internet of Things to build a supply chain information sharing model and describes the entire operation process of the supply chain. The experimental results of this paper show that the application of cloud computing technology to supply chain management establishes a system platform for supply chain information sharing, improves the overall operational efficiency of supply chain management, and realizes supply chain information sharing and business collaboration. In addition, the operating costs and risks of each node enterprise in the supply chain are reduced by 12% compared with the nonsharing situation, which also shows that the overall benefits of the supply chain have been correspondingly improved and market competitiveness has been enhanced.

1. Introduction

With the advent of economic globalization, integration, and the era of knowledge economy, competition among enterprises has intensified. Traditional enterprise management and operation management models can no longer be used in the new market environment. More and more companies are beginning to know how to use supply chain management ideas to achieve synergy between the internal and external environments of the enterprise and conduct integrated management [1]. In this way, customers' satisfaction with the company can be improved,

and the core competitiveness of the company in such an environment can be improved.

Use modern information technology to integrate the business processes of each node enterprise in the supply chain, covering the entire process from upstream enterprise suppliers to end customers [1], establishing partnerships between enterprises, and bringing together the information of each enterprise's independent operation and management in order to finally share the market together. Therefore, the effective operation of the supply chain and the effective sharing of information are of great significance for reducing the bullwhip effect in the supply chain.

Successful precision engineering companies need to master process innovation and supply chain solutions. In these types of businesses, the implementation of innovative collaboration solutions has become a necessary strategy for enhancing the decision-making capabilities of SMEs and improving overall business competitiveness. The purpose of Hernandez research is to introduce how to guide and support SME organizations through online-based cooperation so that it is possible to participate in improved co-operative alliances and how well-designed SMEs can benefit and enhance their capabilities. However, there are certain errors in this study [2]. Mitchell discussed a way for maritime transportation service organizations to improve information sharing in supply chain operations. An action study case study method uses design for six sigma (DFSS) methods to design an information technology solution that can effectively transport information about material movement through inland barges between all levels of the supply chain. However, this sharing method has certain risks [3]. The purpose of this study by Kim MG is to remove the barriers that hinder the adoption/proliferation of radio frequency identification (RFID) in the industry and to help companies develop effective supply chain management (SCM) using RFID by clarifying the specific mechanisms by which RFID affects supply chain performance practice (SCP) [4]. Based on the technology-organization-environment framework, his research studies the technical characteristics and actual environment of RFID in our theoretical model. He studied how the use of RFID can contribute to supply chain information sharing (SCIS) and, conversely, how SCIS affects SCP. However, this research is not practical [5].

The innovation of this paper is as follows. (1) Based on the previous research on the information sharing model, a new core enterprise trustee information sharing model based on active information services is proposed, and an information sharing platform between node enterprises is established. (2) Cloud computing technology to supply chain management is applied [6], a system platform for supply chain information sharing is established, the overall operational efficiency of supply chain management is improved, and supply chain information sharing and business collaboration are realized. At the same time, the mechanism of high-level data coordination and information sharing under this system is studied, and methods and measures to realize information sharing in supply chain management are proposed.

2. Collaborative Management and Information Sharing Method of Supply Chain Inventory Based on Cloud Computing and 5G Internet of Things

2.1. Internet of Things Technology.
RFID technology is the core part of the Internet of Things and the source of information for the entire Internet of Things system [5]. Data information in the Internet of Things is collected in advance through RFID radio frequency technology and then processed through processing [7]. The complete IoT system

mainly consists of the following parts: electronic tags (Tag), readers (Reader), EPC middleware, object name resolution service (ONS), and EPC information service (EPC IS) [8, 9]. Its structure and function flow chart is shown in Figure 1:

In the IoT system, each product has a unique EPC code, which stores the relevant information of the product. First, the reader reads the product EPC code in the electronic tag and then transmits it to the EPC middleware. After sorting and filtering, the information is stored on the corresponding EPC information server. The EPC information service stores the dynamic and static information of the product. It provides guarantee for supply chain information sharing [10]. Similarly, users (any company) can send EPC codes to the object analysis server through the information platform for inquiries. After receiving the request, ONS queries the matching address information, feeds back the information, and guides the EPC middleware to access and store the product information in EPC information server, and EPC information service sends product information to the middleware to feedback to the user so that the user can obtain the relevant information of the product [11, 12].

2.2. Bullwhip Effect in the Supply Chain.
Suppose a simple supply chain with only one manufacturer and retailer is established (the supply chain can also be a four-tier supply chain with suppliers, manufacturers, wholesalers, and retailers). In the t period, the manufacturer predicts the retailer's order quantity in the $t + 1$ period based on the retailer's order quantity historical data [13]. In this supply chain, the manufacturer only faces the retailer for sales and assumes that only one product is sold. Since the retailer is closest to the market, he directly controls the demand information of the end customer, and he can predict the demand information [14]. Assume that the variable d_T represents the demand of the end customer, and this demand is random:

$$d_T = \mu d_{T-1} + \theta_T. \tag{1}$$

In formula 1, μ is a constant and greater than zero; λ refers to the correlation coefficient between demand variables in two adjacent periods, referred to as autocorrelation coefficient, and satisfies $-1 < \lambda < 1$; and θ_T refers to demand the variation error of the variable, and the error is independent in each period [15].

From formula 1, it can be known that this demand variable will change with time [16].

$$e(d_T) = \frac{\mu}{(1 - \lambda)},$$
$$\text{var}(d_T) = \frac{\partial^2}{(1 - \lambda^2)}. \tag{2}$$

Assuming that there is an order lead time L when a retailer places an order from an upstream supplier in the supply chain, the retailer receives the goods ordered from the supplier at the end of the t period every time at the $t + L$ period [17]. It is also assumed that the retailer adopts an (S, s)

inventory strategy to ensure that the product is maintained at a certain level. Suppose order point y_T has the following function at any time t:

$$y_T = l\overline{d_T} + \phi\sqrt{ls_T}. \tag{3}$$

According to the normal distribution function, when $\phi = 1, 3$, there are 84.1% and 99.8% supply rates in L time.

Suppose the retailer adopts the moving average method to predict the market demand and standard deviation [18]. Using d_I to express the customer demand in period I, there is the following formula:

$$\overline{d}_T = \sum_{I-T-N}^{T-1} \frac{d_I}{N}, \\ S_T^2 = \sum_{I-T-N}^{T-1} \frac{\left(d_I - \overline{d_T}\right)^2}{(N-1)}. \tag{4}$$

In formula 4, n represents the number of observation periods selected in the moving average method. The larger the value of n, the more historical data observed and the smoother the processing results [19].

Assume that the variable q_T is the quantity of goods ordered by the retailer from the upstream manufacturer, which satisfies the following formula:

$$q_T = Y_T - Y_{T-1} + d_{T-1}. \tag{5}$$

In formula 5, if the order quantity q_T appears negative, it is stipulated that the supplier allows the retailer to return the excess order quantity without cost. Then, substituting formulas 3–(5), respectively, after sorting, we get the following:

$$q_T = \left(\frac{1+l}{n}\right)d_{T-1} - \left(\frac{l}{N}\right)d_{T-N-1} + \phi\sqrt{l}\left(s_T - s_{t-1}\right). \tag{6}$$

For the order quantity q_T in formula 6, take its variance and get the following:

$$\mathrm{var}\left(q_T\right) = \left[1 + \left(\frac{2l}{N} + \frac{2l^2}{n^2}\right)\left(1 - \lambda^n\right)\right]\mathrm{var}\left(d_T\right) + \phi^2 l\,\mathrm{var}\left(s_T - s_{t-1}\right). \tag{7}$$

It can be seen from equation (7) that the second term at the right end is a non-negative number. Divide it by $\mathrm{var}(d_T)$ in equation (2) to get a value and get equation (8). And, this value represents the ratio of the variance of the order quantity received by the manufacturer to the variance of the quantity received by the retailer from the customer. Therefore, this formula can be used as the quantitative formula be of the bullwhip effect.

$$\mathrm{be} = \frac{\mathrm{var}\left(q_T\right)}{\mathrm{var}\left(d_T\right)} \geq 1 + 2\left(1 - \lambda^N\right)\frac{l(l+N)}{N^2}. \tag{8}$$

From the above analysis of applying the moving average method to forecast, it is also applicable to other forecasting methods. The following uses the exponential smoothing method for predictive analysis. From the results discussed above with the moving average method, we can derive the

quantitative formula be of bullwhip effect under the exponential smoothing method in the same way, which has the following formula:

$$\mathrm{be} = \frac{\mathrm{var}\left(q_T\right)}{\mathrm{var}\left(d_T\right)} \geq 1 + \left(\frac{2l\,\partial + 2l^2\partial^2}{2 - \partial}\right)\left[\frac{(1 - \partial)}{(1 - \lambda\beta)}\right]. \tag{9}$$

In equations 8 and 9, we can clearly see that the demand information becomes larger after being transmitted from the retailer to the manufacturer in the supply chain, which produces the bullwhip effect [20, 21]. Although the above two forecasting methods can more accurately verify that the demand information in the supply chain has been distorted and increased and can give the results of quantitative analysis, they cannot provide a detailed positioning and description of the process of information increase, and it is impossible to know how to affect it [22].

In a supply chain that adopts information sharing, relevant information such as demand information, forecasting methods, and inventory decision models can be shared so that each level of the supply chain can obtain the demand forecast information of the first-level member retailer and then make corresponding decisions based on shared information [23].

Assuming that the supply chain implements information sharing, the downstream member retailers will pass the end customer demand information they have to the members at all levels through information sharing [24]. In this way, each level member has the actual demand information of the end customer. Assuming that each level member in the supply chain uses the moving average method to predict and analyze the average demand of the next level based on n observation values of demand, then

$$\overline{U_T} = \sum_{I=1}^{N} \frac{d_{t-1}}{N}. \tag{10}$$

Equation (10) means that in unit time, the predicted demand of each level member uses the same estimated value. Assuming that every member of the supply chain adopts the same inventory strategy, the order points are as follows:

$$Y_T^K = l_K.\overline{U_T^K} + \phi\sqrt{l_K s_T^K}. \tag{11}$$

Combining equations 5 and 7 to derive, it is concluded that in the case of information sharing, the ratio of variance between q_T^K in the supply chain and d_T of end customer demand is as follows:

$$\frac{\mathrm{var}\left(q_T^K\right)}{\mathrm{var}\left(d_T^K\right)} \geq 1 + 2\sum_{I-1}^{K-1}\frac{l_T}{N} + 2\sum_{I-1}^{K-1}\frac{l_T^2}{N^2}. \tag{12}$$

The premise of formula 12 is that the supply chain needs to realize information sharing, the demand information mastered by each level member needs to be shared in the supply chain, and the forecasting method and inventory strategy adopted by each level member need to be consistent [25].
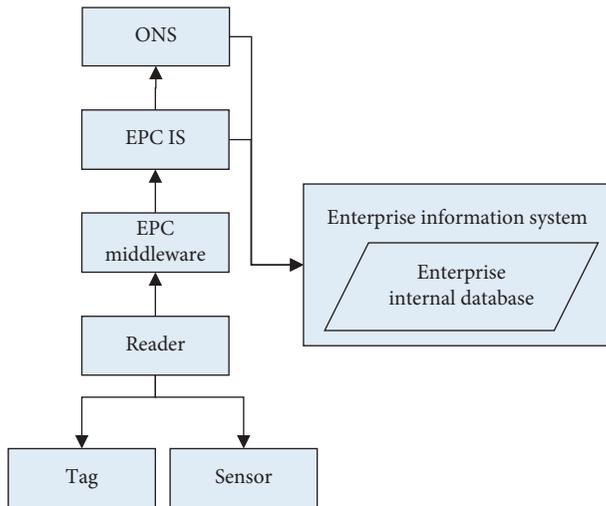
Figure 1: The structure and functions of the Internet of Things.

2.3. Supply Chain Information Sharing Mechanism. The importance and value of information sharing in supply chain cooperation are obvious. However, the above analysis limits the application of information sharing to a certain extent. Therefore, it is necessary to establish an effective information exchange mechanism to encourage member companies to participate in information exchange and maximize the level of information exchange.

This paper has conducted some research on the information sharing mechanism [25]. In the process of studying the value of common information, researchers found that although the implementation of information exchange can improve the overall performance of the supply chain and reduce the overall cost, the problem is that the distribution of new profits has not been resolved. When determining the value of demand information, Lee et al. pointed out that retailers did not directly benefit from information exchange. If there is no proper mechanism to coordinate interests, it may generate disproportionate benefits and investment, and some member companies are reluctant to participate in information exchange. Therefore, it is necessary to establish an incentive mechanism to encourage all parties to achieve a win-win situation [26]. The incentive mechanism is an agreement or rule issued by the authorized commissioner to the representative according to the main agency relationship so that the representative's behavior conforms to the wishes of the authorized official. In the supply chain relationship, suppliers, manufacturers, and distributors will form different principal-agent relationships as needed. At present, when investigating information exchange in the supply chain, most of them first establish a specific agency relationship and then propose a mechanism to encourage information exchange. The design of this mechanism is based on the neutral risk assumption of the main factors [27]. However, the members of the supply chain are not a simple principal-agent relationship, but in this kind of cooperative relationship, you and the members have different attitudes towards risk. In the actual management of the supply chain, information exchange is two-way, and each member country

should cooperate in information exchange and share the benefits of information exchange; it should be allocated to members reasonably [14].

2.4. Supply Chain Collaborative Management Methods. Generally speaking, supply chain coordination management includes seven aspects: specific content strategy coordination, information coordination, information coordination, trust coordination, cultural coordination, business coordination, form coordination, and distribution coordination. The research center of this paper is trust and information cooperation [28].

2.4.1. Trust Collaboration. The cooperative relationship between supply chain node enterprises is based on trust. Only by establishing a perfect trust mechanism can the efficiency and long-term competitive advantage of the entire supply chain be guaranteed [29]. Strengthening mutual trust can intensify cooperation between business nodes and improve the flexibility of production and service and the ability to respond to emergencies. Newcomer coordination reduces unnecessary frictions and conflicts and reduces the resulting consumption of people, money, materials, and time.

2.4.2. Information Collaboration. This is a key factor for the success of supply chain management [30]. In order to ensure the best operation of the entire supply chain, each node company in the supply chain has formed such a relationship, division of labor, cooperation, independence, and integration. The basis of this division of labor, cooperation, and independent integration is the relationship between supply chain nodes, which is easy to transmit and exchange information dynamically. Only when each node in the supply chain has good information exchange, the supply chain can become an organic network organization, which is truly guided by the needs of end users and ensures that the transmission of customer demand information will not be distorted or delay, thereby effectively reducing the negative impact of the bullwhip effect [9].

3. Cooperative Management and Information Sharing Experiment of Supply Chain Inventory Based on Cloud Computing and 5G Internet of Things

3.1. Supply Chain Model Design. The content of this article is not to prove the existence of the "bullwhip effect" but to study the value of information sharing in the supply chain system and help companies in the supply chain to more intuitively understand the supply chain implementation of information sharing through the advantages of simulation software. Therefore, in this article, only a simple single-chain five-tier structure including customers is considered.

In this supply chain process, there are the following 4 links, which are analyzed as follows:

(1) *Purchasing Products.* This link occurs between the customer and the retailer, and the retailer meets customer needs in a timely manner and quickly processes customer orders.

(2) *Replenishing Inventory.* This link occurs between retailers and wholesalers and between wholesalers and manufacturers. This link is similar to the previous link, except that this time the customer has become a retailer or wholesaler. The purpose of replenishing inventory is to enable retailers or wholesalers to provide products to downstream members in a timely manner to avoid losses due to shortages. The order completion process in this link is the same as the customer order completion process, but the object is different. However, there is a big difference, that is, there is a big gap between the order quantities of the two orders, and the supplementary inventory orders of retailers or wholesalers are much larger than customer orders.

(3) *Product Production.* This link occurs between wholesalers and manufacturers, and it is triggered by customer orders and retailer or wholesaler replenishment of inventory orders. The wholesaler compares the demand forecast with the inventory level it owns, formulates a corresponding ordering strategy, replenishes the inventory, and then transmits the order to the manufacturer. Manufacturers make plans for production based on their own supply level and downstream demand analysis.

(4) *Raw Material Acquisition.* This link occurs between the manufacturer and the supplier, which is similar to the relationship between the retailer and the wholesaler, but there is one difference, that is, the retailer uses the uncertain demand of the end customer to increase. It is ordered by wholesalers, and when the manufacturer obtains raw materials from upstream suppliers, the demand is accurately calculated according to the production plan.

3.2. Cloud Computing-Based Supply Chain Information Collaboration System Architecture. The structure of the supply chain information cooperation platform should include four overall levels. The first layer is the level of infrastructure, including computer servers, network equipment, cloud servers, and cloud storage devices. It is the foundation of all application functions, providing parallel computers and large-capacity storage and other required cloud IaaS infrastructure services. The second layer is the cloud system service layer, which provides interfaces and software operating environment for system development and provides system service functions such as user management, manages access codes, management permissions, management records, and traffic statistics. It is a business cooperation cloud computing and information exchange system service platform [31]. The third layer is the cloud computing application service layer, that is, the cloud computing application virtualization service platform layer, which provides SaaS online software services, including order information, production and inventory information, and various functional units, such as sales services, distribution services, return services, and settlement. Information is the main work area of information exchange and supply chain cooperation. The fourth level is the access level of users who use personal computers, portable phones, and other terminal devices to transmit, process, and receive information and respond quickly to information. The above four levels constitute a complete "cloud computing" supply chain business collaboration and information sharing platform architecture.

3.3. Construction of Supply Chain Information Sharing Mode of EPC Internet of Things. The Chinese name of EPC is an electronic product code, which is a set of numbers, consisting of a question number and three other data parts (domain name management, object classification, and serial number). It is a set of numbers for each physical item (including retail product units, unique identifiers for containers, and cargo packaging). EPC solves the problem of identifying and monitoring individual products and establishes a global open label standard for each product. The EPC system is a physical Internet, which can automatically identify and exchange information in real time on a global scale and is constructed from the computer Internet using technologies such as RFID and wireless data communication.

On the physical Internet consisting of EPC tags, card readers, medium-sized EPC software, Internet, ONS server, EPC information Service (EPC IS) and many databases, the EPC read card reader is just an information report (index); this information refers to finding the IP address and receiving relevant information stored in the address and using distributed EPC media software to process a group of EPC information read by the card reader. Since there is only one EPC code on the label, the computer should know other information that matches the EPC. This requires the National Bureau of Statistics to provide automated network database services. The medium-sized EPC software transmits the EPC code to ONS, and ONS orders the medium-sized EPC software to search the server (EPC IS) that stores the product files. The file can be copied from the media EPC software so that the product information in the file can be transferred to the supply chain. The workflow of the EPC system is shown in Figure 2.

4. Supply Chain Inventory Coordination Management and Information Sharing Mechanism

4.1. Effect of Collaborative Management and Control of Supply Chain Inventory. Through data analysis of orders, it is found that there is an average value for commodity prices, wholesaler inventories, retailer inventories, and manufacturer inventories. The actual values fluctuate up and down on the average value. There are few extreme cases in the value. Preliminary research shows that the standard is positive state distribution.
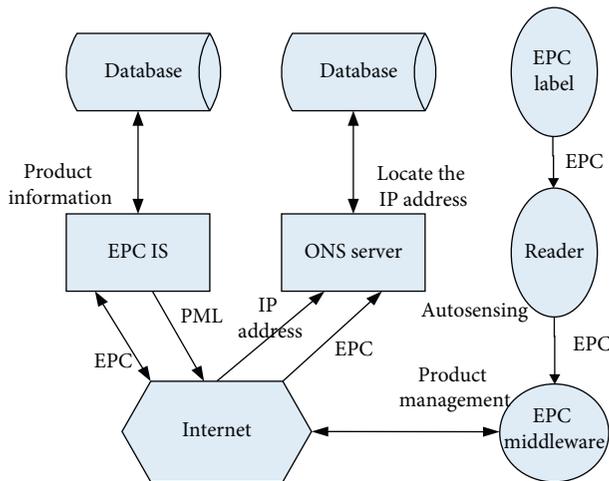
Figure 2: The workflow of the EPC system.

The demand forecast and the sensitivity analysis of each inventory are done. The analysis results are shown in Table 1 and Figure 3.

From Figure 3, we can find that the demand forecast and each inventory are significantly affected by the parameters, indicating that the model is reasonable and more in line with the actual operation of the system.

To further reflect the degree of influence of various variables on the overall supply chain inventory management under the condition of collaborative management, a further scenario analysis was made.

4.1.1. The Degree of Influence of Price on Each Inventory.
The reference price of the collaborative platform is modified to increase by 10% compared with the original. The simulation results are shown in Table 2 and Figure 4.

The data in the figure reflect that price changes have a relatively large impact on changes in consumer demand and inventory at various nodes in the supply chain. The trend of change has changed, but the general trend has not changed. The reason is that this order, as a fast-moving consumer product, has a large price elasticity coefficient. The increase in price causes a decrease in demand. The transmission of demand information through the collaborative platform obviously leads to a decrease in inventory at each node of the supply chain.

4.1.2. The Impact of Consumer Demand on Each Inventory and Price in the Previous Period.
Increase consumer demand by 10% in the previous period and conduct a simulated comparative analysis to check the changes in each inventory and price. The result is shown in Figure 5.

The data in the figure reflect that after the last period of consumer demand increased by 10%, the inventory and price did not change too much, and the trend of the change was also the same as before, indicating that the increase in consumer demand in the last period had an impact on the overall the degree of influence is not high and the price fluctuation is weaker. The reason is that after consumer

demand in the previous period increases, the collaborative platform can make timely predictions for the next period for data prediction, which increases inventory consumption while increasing inventory incoming volume so that the final inventory does not change too much. Scenario analysis is carried out on other variables in the model, and the study finds that price has a greater impact on supply chain collaborative inventory management, indicating that supply chain collaborative inventory management needs to focus on recording and analyzing prices in the actual operation process [1].

4.2. Value Analysis of Information Sharing in the Supply Chain

4.2.1. Comparative Analysis of Bullwhip Effect under Nonsharing and Sharing.
In traditional supply chain management, the order information issued by upstream companies and downstream companies is used as the basis for demand forecasting, and the predicted results are often larger than the actual demand. Therefore, the most effective way to reduce the bullwhip effect is to realize information sharing in the supply chain, not only sharing customer demand information with each level member of the supply chain but also sharing the information of each member in the supply chain. Integrate all information to forecast demand instead of relying on the only order information from downstream to make forecasts. In order to further illustrate the value of information sharing in the supply chain, the following uses the moving average prediction method to quantitatively analyze the bullwhip effect in the supply chain with or without information sharing and compares them.

According to the above formula, set BE as the ordinate and the number of observation periods n as the abscissa. The number of observation periods is $k = 1$, 4, and 6, respectively. The results are shown in Table 3 and Figure 6.

The above results are the bullwhip effect of supply chain information in the case of nonsharing and sharing. According to the data analysis in the figure, it can be seen that when $k = 1$, that is, the first-level member retailer in the supply chain, the retailer directly faces the needs of end customers, regardless of whether the information in the supply chain is shared, and the result is the same Yes, both have the same bullwhip effect pattern. When $k = 4$ or 6, the bullwhip effect in the case of information sharing is significantly lower than that in the case of no information sharing.

4.2.2. Inventory Comparison of Retailers and Wholesalers under Nonsharing and Sharing.
Since the retailer of the first-level member of the supply chain always faces the needs of end customers and the needs of end customers are the same in the case of supply chain implementation and nonimplementation of information sharing, the retailer is in order to meet customer needs in a timely manner. The inventory level maintained should also be the same in the case of information sharing and nonsharing; retailers will share the actual demand information of end customers so that upstream companies in the supply chain

TABLE 1: Sensitivity analysis table.

Time (week)	1	8	15	22	29	36	43	50
Consumer demand forecast	0	0	0	0	72.15	657.57	345.45	489.80
Retailer inventory	0	0	0	0	54.24	1384.87	-680.10	3.40
Wholesaler inventory	17.65	14.24	11.11	4.32	-2.34	-962.63	-711.34	-165.45
Manufacturer inventory	17.65	14.22	11.23	-9.23	-721.87	22.85	-478.36	-503.89
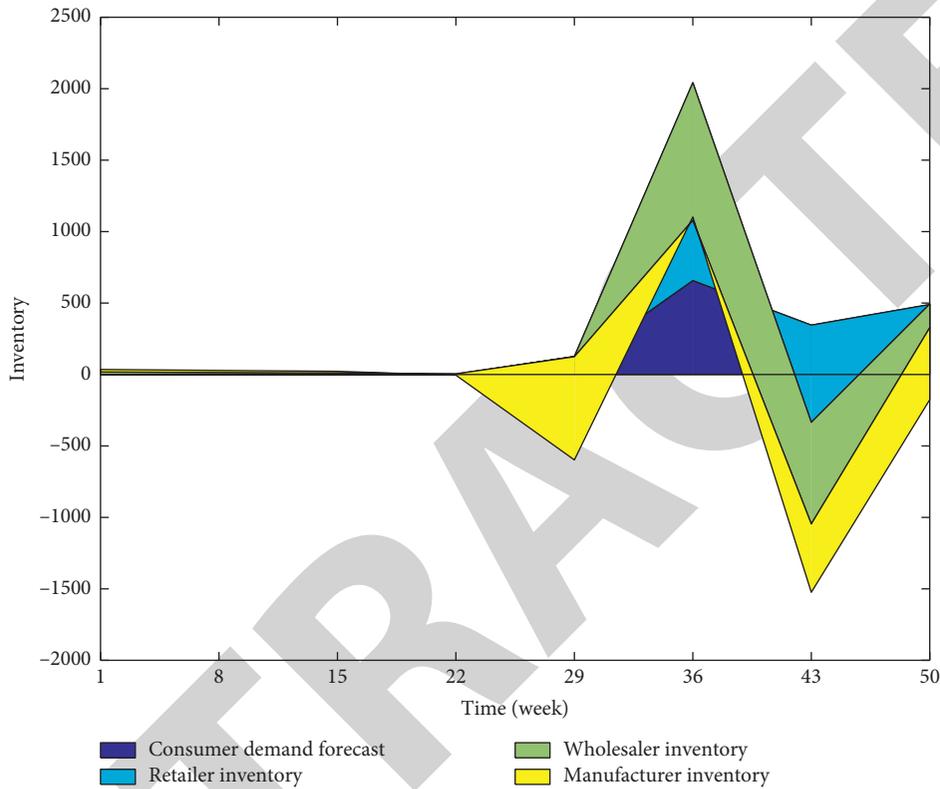
FIGURE 3: Sensitivity analysis.

TABLE 2: The impact of price on each inventory.

Time(week)	1	4	7	10	13	16	19	22	25	28
Consumer demand forecast-current	1	1	0	1	3	25	13	10	5	3
Consumer demand forecast-change	1	1	0	0	1	6	2	1.5	0.5	0
Retailer inventory-current	10	13	8	10	10	30	60	-17	-6	2
Retailer inventory-change	10	13	8	10	10	13	11	0	4	6
Wholesaler inventory-current	11	11	8	11	11	11	11	-24	-8	11
Wholesaler inventory-change	11	11	8	11	11	11	7	5	9	3
Manufacturer inventory-current	20	18	19	19.5	19	14	-23	20	-4	14
Manufacturer inventory-change	20	18	19	19.5	19	17	14	19.5	15	19

can grasp the information of downstream companies in a timely manner to formulate relevant information. Upstream companies in the supply chain can formulate inventory plans based on corresponding order information or production plans to meet the needs of downstream companies, so they do not have to worry about inventory issues. Compared with the case of nonshared information, the inventory is much lower. The results are shown in Table 4 and Figure 7.

4.2.3. Comparative Analysis of Manufacturers' Inventory under Nonsharing and Sharing. The farther the bullwhip effect is from the customer, the greater the demand fluctuation will be. In the case of nonsharing, the manufacturer produces according to the order information of the subordinate members, and the information is transmitted and modified at the first level of the supply chain, which finally causes the demand information to be distorted and enlarged, causing the manufacturer to produce too many products and
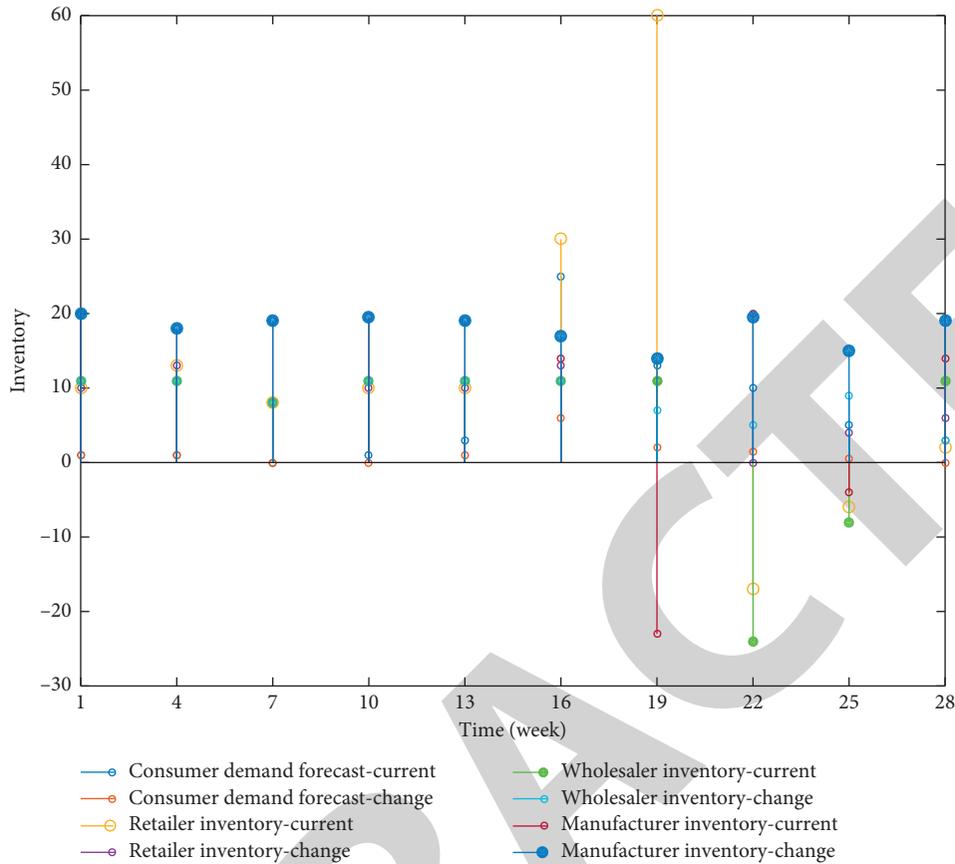
Figure 4: Degree of influence of price on each inventory.
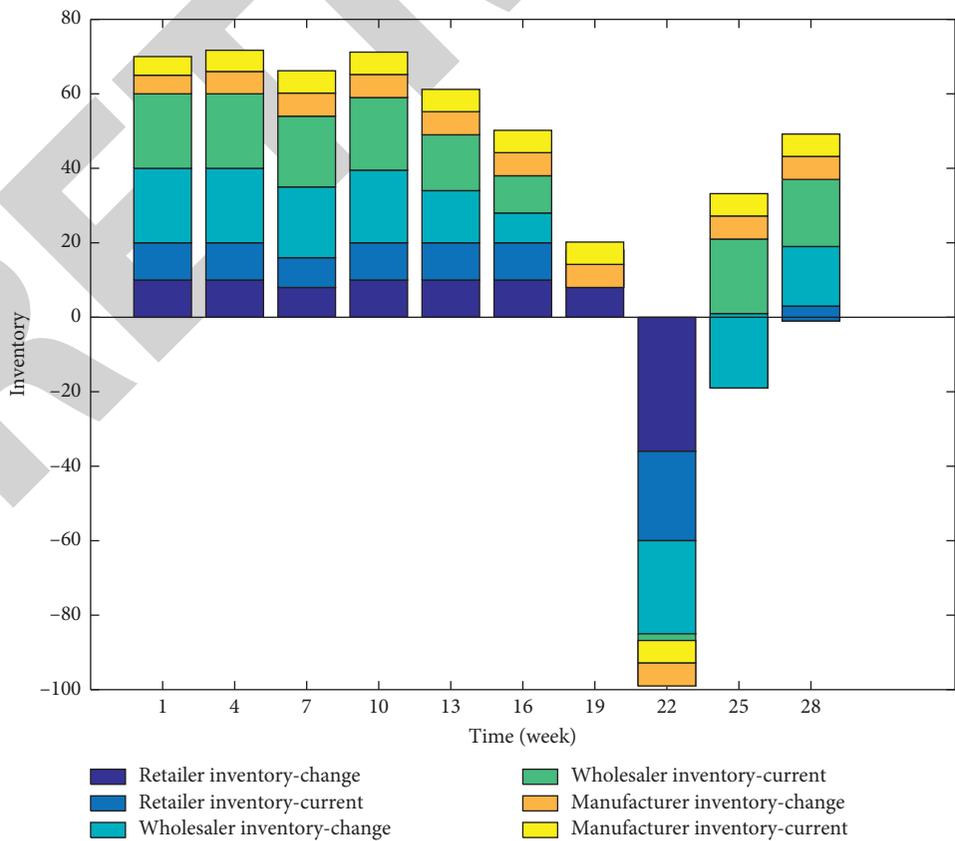

Figure 5: The degree of influence of consumer demand on each inventory and price in the first period.

TABLE 3: Comparison of the bullwhip effect with or without information sharing in the supply chain.

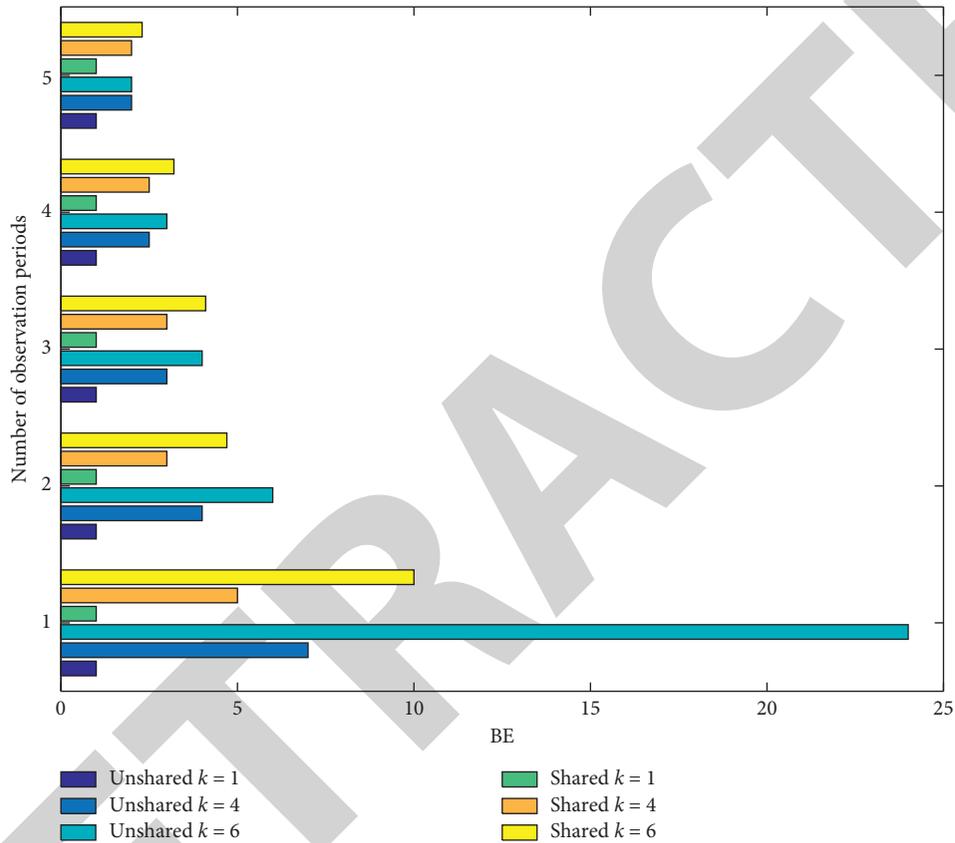| Information sharing	Unshared $k = 1$	Unshared $k = 4$	Unshared $k = 6$	Shared $k = 1$	Shared $k = 4$	Shared $k = 6$
1	1	7	24	1	5	10
2	1	4	6	1	3	4.7
3	1	3	4	1	3	4.1
4	1	2.5	3	1	2.5	3.2
5	1	2	2	1	2	2.3

FIGURE 6: Comparison of bullwhip effect with or without information sharing in the supply chain.

TABLE 4: Inventory comparison of retailers and wholesalers under nonsharing and sharing.

Simulation value point	1	2	3	4	5	6	7	8
Nonshared-retailer inventory	0	100	48	73	25	1	0	0
Share-retailer inventory	0	98	46	73	22	2	1	0
Nonshared-batch distributor inventory	0	150	30	0	17	0	19	0
Sharebatch distributor inventory	0	170	60	11	10	11	16	0

a large backlog of inventory; under sharing, the manufacturer obtains the shared information and directly grasps the terminal customer demand information and then makes predictions and formulates the production plan based on this. As shown in Figure 8, the inventory level of producers

under nonsharing is significantly greater than that under sharing.

To sum up, we can learn from the above analysis of the results that when the supply chain implements information sharing, the operating costs and risks of each node enterprise
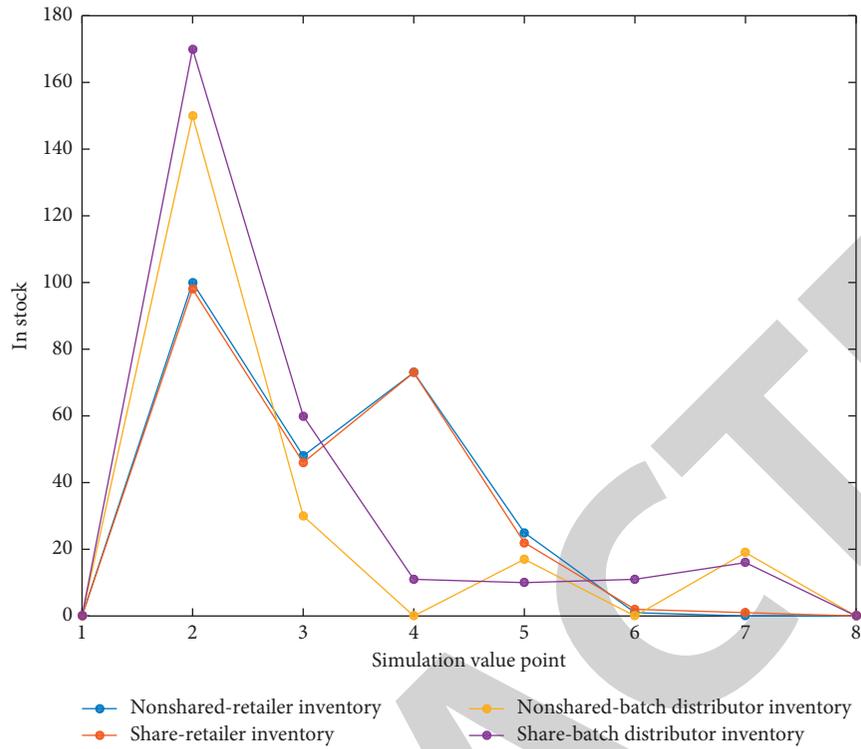
Figure 7: Inventory comparison of retailers and wholesalers under nonsharing and sharing.
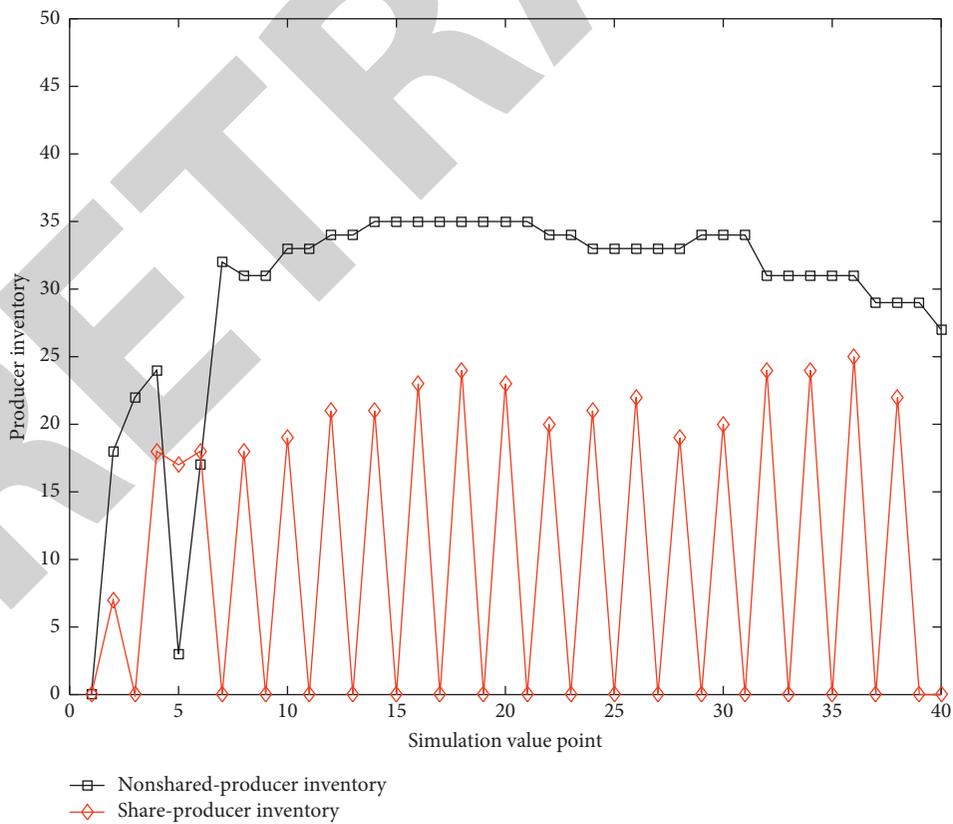

Figure 8: Comparison of manufacturer inventory under nonsharing and sharing.

in the supply chain are lower than those in the case of nonsharing [32], and it also illustrates the overall supply chain benefits are correspondingly improved, and market competitiveness is enhanced. The simulation results have good guidance and reference significance for the operation of enterprises in reality.

5. Conclusions

This article proposes an inventory management information platform framework that adapts to the environment of the Internet of Things, that is, the Internet of Things inventory management information platform. Through this information platform, the inventory information or other operational information of each node company can be provided to other companies in the supply chain through the service interface so as to achieve the role of information sharing and transmission, effectively reducing the uncertainty of the supply chain and reducing the impact of the bullwhip effect.

The supply chain is a complex system that requires members to share information to reduce the bullwhip effect, achieve synchronization of decision-making, reduce inventory, and improve market response. Therefore, information sharing is an important content of supply chain research. In the research of information exchange, most of the researchers put forward the incentive mechanism to promote information exchange on the basis of specific relationship and the lack of research on the information exchange mechanism in supply chain management. On this basis, this article focuses on this issue and discusses the relationship between the benefits, costs, risks, and the relationship between the supply chains in the information exchange implementation mechanism.

Due to time constraints and lack of experience, this information platform still has some shortcomings. (1) The interface design of the information platform is not perfect. Enterprise informatization will become an indispensable part of the future development of the enterprise. The inventory information of the Internet of Things is not very clear about the integration of enterprise resources and management systems. (2) The functionality of the system is not good enough. Although the asynchronous technology used in the system reduces the transmission of data and improves the user's operating experience, due to the shortcomings of the system itself and the degree of support of the browser, the system is in the human-machine interface, operation method and the response time cannot meet the demand well.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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